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EVALUATION OF THE TOWN OF PALMERSTON SEWAGE TREATMENT PLANT

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of the
Environment

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EVALUATION OF
THE TOWN OF PALMERSTON
SEWAGE TREATMENT PLANT

1977

BY

MINISTRY OF THE ENVIRONMENT
WEST CENTRAL REGION

17777

ABSTRACT

A loading study was undertaken at the Palmerston Activated Sludge Sewage Treatment Plant during 1976. This report evaluates the treatment capability of the plant using the data obtained during the study. It also compares various types of activated sludge treatment processes with the process used at Palmerston.

Sampling and flow measurement indicated that the average daily flow is about twice the plant's capacity, that wastewater entering the plant is very dilute, that the plant efficiency is low, and that extensive by-passing occurs.

A unit by unit evaluation of the plant was undertaken. In the aeration section, volatile suspended solids were virtually absent and, as a consequence, synthesis of organic wastes is minimal. Concentrations of suspended solids in the return sludge were also minimal. Thus, a healthy microbial population in the aeration section was absent. Consequently, excessive suspended solids were discharged to the Wallace drain instead of being returned to the aeration section, to the detriment of both.

The absence of standby power results in a greatly reduced level of treatment during interruptions in power supply. The condition of the aging air compressor, the stress applied to the plant through surges by the oversized pump which lifts sewage to the operating level and the excessive by-passing of sewage all contribute to the problems described in the report.

The aeration section and, more significantly, the final clarifiers are undersized. There is no chlorine contact chamber or chlorination equipment, so chlorination of the final effluent cannot be effected.

Ancillary problems are that a fully trained full-time operator and testing equipment are not available at the plant. However, the outdated and undersized plant and its equipment were the cause of most of the problems.

In summary, the plant is treating sewage inadequately and it appears impractical to modify the plant to achieve adequate sewage treatment. It is, therefore, a matter of urgency that a completely new sewage treatment facility be provided at Palmerston.

Discussion of details of the report may be held with F. J. Iliffe or W. Merritt, Ministry of the Environment office at Cambridge, 400 Clyde Road, Phone (519) 623-2080.

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EVALUATION
OF THE
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SEWAGE TREATMENT PLANT

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1. INTRODUCTION

1.1 PURPOSE OF REPORT

For several years, the Ministry has been concerned about the effectiveness of the treatment being provided at the Palmerston Sewage Treatment Plant. In order to obtain a current assessment, a loading study was undertaken by Ministry Municipal and Private Abatement Staff. The purpose of this report, therefore, is to present the study results to evaluate the treatment capabilities of the facility and to make recommendations for solution of problems encountered.

1.2 BACKGROUND

The town of Palmerston is situated in Wellington County. The 1977 Municipal Directory lists the 1976 population of the town as 1,969 persons. The predominant land use within the town is residential.

The municipally owned activated sludge sewage treatment plant (see Appendix I for definition) was constructed in 1928. Since the inception of the Ontario Water Resources Commission, it has been recognized and outlined in a number of inspection reports (see Appendix II) that operating difficulties were being experienced within the plant. Subsequently, an operating agreement between the Town of Palmerston and Ministry of the Environment was drawn up (see Appendix III). The operating agreement does not cover the sanitary and storm sewer system.

1.3 EXISTING FACILITIES

1.3.1 Collector System

The original sewer system was designed to transport both sanitary sewage and storm waters to the sewage treatment plant. A pumping station located on Prospect Street lifts sanitary sewage from this area up into the gravity system.

Over the Past 10 years, the Town has been involved in a program of sewer separation resulting in a portion of the storm water run-off being diverted to a network of storm sewers.

1.3.2 Sewage Treatment Plant

Preliminary treatment consists of a coarse bar screen and two grit channels. Wastewater is then directed to an aeration section consisting of two tanks. Final sedimentation is achieved in two "hopper" shaped sedimentation basins. Wastewater leaving the final clarifiers is discharged to a Municipal drain. A storm tank was provided for utilization during periods of high flow. (Complete system details are contained in Appendix VII).

1.4 ASSESSMENT OF OPTIMUM TYPE OF ACTIVATED SLUDGE PROCESS AT PALMERSTON

In order to determine the type of activated sludge process which should be used, a review of the capacity of the individual treatment units was undertaken; flows and organic loading entering the plant and general loading and operational parameters for activated sludge processes were also examined (See Appendix IV).

It was thus determined that, for effective treatment, the hydraulic capacity should probably be limited to about 150,000 gpd and the organic loading should probably be held within the range 210 to 275 lb/day BOD_5. This determination entailed the assumption that the following criteria were met:-

a) That loading to the aeration section is 30-40 lb. of BOD per 1000 cubic feet of inflow.

b) That the aeration period at design flow is not less than 6 to 7.5 hours.

c) That the surface settling rate is not less than 600 gpd per square foot at peak flow considering non-mechanical clarifiers.

As indicated in Appendix IV, the loadings on the aeration section are such that the processes used at the Palmerston plant do not correspond to any of the separate types of activated sludge processes currently considered by sanitary engineers as having merit.

2.0 MINISTRY 1976 LOADING STUDIES

2.1 STUDY PERIODS

April 29 to June 3 - 24 hour composite sampling.
November 1 and 2 - six hour effluent composite samples.

2.2 AVERAGE DAILY FLOWS

Prior to discharge, final effluent passes through a V-notch weir. Once a day, as a normal part of plant operation, the operator measures and records the approximate flow, using a calibration device near the weir. Thus it has been estimated that the plant has treated an estimated 238,000 gallons of sewage per day for the past two or three years, but no measurements of by-passes, which have been substantial and which normally occur each day, have been made. In order to obtain a more accurate evaluation of the sewage flows, two continuous flow recording devices were installed. A breakdown of the flows recorded is contained in Appendix V.

In general, plant flows were well above those previously estimated. By-pass flows occurred every day during which flows were measured.

Based on an hydraulic capacity of 150,000 gpd, the average daily flow entering the plant was approximately 203 percent of hydraulic design during the study period.

2.3 ORGANIC LOADING

The estimated optimum average daily organic loading which the Palmerston Sewage Treatment Plant should be capable of treating, lies in the range of 210 to 275 lbs. BOD_5 per day. This estimate is based on an average daily sewage flow of 150,000 gpd and aeration tank loadings of 30 to 40 lbs. of BOD per 100 cubic feet.

Based on 36 composite 24-hour samples obtained from April 20 to June 3 inclusive, (Appendix VI) the average strength of incoming wastewater expressed in terms of BOD_5 was 44 mg/l. On November 1 and 2, 1976, based on 8 composite 6-hour samples, the strength was 40 mg/l.

Experience elsewhere indicates that 0.17 lb. of BOD_5 is normally generated per capita day, but the corresponding figure in Palmerston is much smaller. Thus, 340 lb. of BOD_5 would have been anticipated but, based on an average flow of 304,000 gpd and a BOD_5 concentration between 40 and 44 mg/l, between 122 and 134 of BOD_5 were actually produced.

In general, the organic loadings were within the plant's treatment capacity. However, average daily flows well in excess of the plant's design hydraulic capacity coupled with a weak domestic wastewater, rendered the treatment process ineffective.

2.4 TREATMENT EFFICIENCY

Generally, an activated sludge process, irrespective of type, should remove 85 to 95 percent of both BOD_5 and suspended solids. Analyses of grab samples obtained by the plant operator during 1973, 1974, 1975 and 1976 and the analyses of composite samples obtained by the Ministry during the 1976 sampling program are contained in Appendix VI.

The analyses indicate that treatment efficiency at Palmerston is low.

Further factors contributing to the plant's inability to satisfactorily treat incoming wastewater are examined in Section 3 of this report.

3.0 EXAMINATION OF EXISTING PLANT AND RESULTS

3.1 INFLUENT WORKS - DESCRIPTION

Two sewers discharge to the head of the influent channel. A third, whose inlet elevation is well below that of the others, discharges to a deep manhole approximately 20 feet away.

Sewage from the manhole is directed to a wet well abutting the plant's control building. A float controlled 400 gpm pump lifts the sewage through a forcemain and discharges it to the influent channel beside the other sewer outlets.

Problem Areas

3.1.1 Bar Screen - Influent Channel

Preliminary treatment is effected by a coarse bar screen located slightly downstream from the sewer inlets. The bar screen is cleaned manually and screenings are piled up beside the influent channel.

It is not known how frequently the screenings are removed. However, during the loading study, screenings had accumulated for at least two to three months. The pile was unsightly and its odour offensive to anyone in the immediate area. In addition, it represents a potential health hazard to individuals who, by accident, may come into contact with it. Despite representations by Ministry staff, both from the Abatement and Operations groups on numerous occasions, to Palmerston officials that other arrangements should be made, the problem persists.

3.1.2 Bar Screen - Inlet Manhole

The coarse bar screen located in the discharge side of the manhole was maintained in a raised position. Consequently, flotsam normally removed by the screen, was gaining access to the wet well.

If this practice is continued, the wet well pump may become plugged or damaged. Removal of debris is difficult because it is inaccessible. On the other hand, if the bar screen is utilized, accumulated debris could impede the flow of incoming sewage. Surcharging of the sanitary trunk sewer could then occur. Homes situated in the sewer's drainage area might be subject to sewage back-up. If the plugged bar screen were raised to drain the surcharged sewer, large volumes of wastewater would be directed to the wet well, which could result in raw sewage by-pass.

3.2 STORM TANK - DESCRIPTION AND PROBLEM AREAS

The storm tank's original purpose was to retain flows in excess of the plant's peak hydraulic capacity. The contents would be returned to the plant for treatment during low flow periods.

The combined flow of the two gravity sewers and forcemain is usually in excess of the influent channel's hydraulic capacity. Consequently, excess sewage flows over the wall separating the influent channel from the storm tank.

A weir at the downstream end of the storm tank permits discharge into the Wallace drain. Prior to our sampling program, wet spring weather had made removal of bottom sludges in the tank impossible. Consequently, much of the tank was occupied by septic bottom sludges. These had not only reduced the tank's effective storage capacity but had also contributed substantially to offensive odours by anaerobic decomposition of organic materials. Due to the constant hydraulic overload, the tank is never emptied. Thus, it is never able to serve its intended purpose of retaining storm flows.

Between May 22 and June 3 inclusive, a period of 13 days, approximately 328,000 gallons of raw sewage were by-passed in this way. Assuming a BOD_5 concentration of 40 mg/l in raw sewage (See Section 2.3), it is estimated that 131 lbs. of BOD_5 were by-passed during this period alone. Due to the constant hydraulic overload, it is not practical to empty the storm tank. Thus, the storm tank has no capacity to retain excess flows. The handrails do not meet Ministry of Labour standards and are judged unsafe. In summary, the storm tank serves no useful purpose and presents environmental and safety hazards.

3.3 GRIT REMOVAL CHANNELS - DESCRIPTION

Grit removal is effected in two grit channels. Normally, sewage is directed through one tank, to permit cleaning and disposal of settled solids from the adjacent chamber. A channel type of grit removal unit is normally designed to provide a controlled horizontal velocity of 1 fps. A velocity greater than 1 fps will cause scouring of the settled grit and impede satisfactory settling of the suspended solids. If the horizontal velocity were limited to a maximum of 1 fps by using proportional weirs, each unit would be capable of removing grit from flows of sanitary sewage well in excess of present flows.

Problem Areas

During the survey and subsequently, only one grit channel has been operational. Problems with the gate valve at the downstream end of the other channel have rendered it inoperative.

The unused channel contained bottom sediment, the organic portion of which had become septic, unsightly and foul smelling.

As grit cannot be readily removed from the operational channel, it is never taken out of service. A build-up of settled solids has consequently occurred. During periods of high flow, bottom sediment is scoured off and carried over into the aeration section. Regular grit removal, as has been pointed out to Town officials on several occasions is necessary for proper plant operation.

The defective channel valve should be repaired and, in addition, proportional weirs should be installed in the downstream ends. These would permit the horizontal velocity in the tank to remain relatively constant over a wide range of flows.

3.4 SECONDARY TREATMENT - AERATION TANKS

Flow from the grit channel is directed to two, two-pass diffused air tanks. The air supply is provided by the original compressor.

Problem Areas

3.4.1 Tank Size

The total volume of the aeration section is 44,200 Imperial gallons. In a properly designed plant, the aeration period should be at least 6 to 7.5 hours to ensure stabilization of organic matter and production of activated sludge with good settling characteristics. Flows to this section should not be greater than 140,000 to 175,000 gpd.

Actual flows averaged 304,000 gpd. Thus, the aeration period was approximately 3.5 hours, or significantly less than the time necessary to produce an activated sludge with good settling characteristics.

3.4.2 Return Sludge Rate

Micro-organisms respond best, in most cases, when receiving approximately one-quarter to one-half of their weight in food per day, i.e., the food to micro-organisms ratio (F/M) should be between 0.25 and 0.50. This ratio is obtained by dividing the total weight of BOD per day in the incoming wastewater (F) by the total weight of volatile suspended solids (M) in the aeration tank. Control of this ratio can be accomplished by wasting sludge. On November 1 and 2, 1976, a sample of the aeration section contents was analyzed for volatile suspended solids. Results of the analyses are as follows:

SUSPENDED SOLIDS			VOLATILE SUSPENDED SOLIDS
Date	mg/l	Percent VSS	mg/l
Nov 1	225	56	126
Nov 2	336	45	151

During the same period, two grab samples of the sanitary sewage entering the plant were obtained and analyzed for BOD_5. Results of the analyses indicated the BOD_5 of both samples was 42 mg/l.

From this data, F/M ratios of 2.3 and 1.9 were calculated. It is therefore clear that the quantity of micro-organisms contained in the aeration section should have been ten times greater than it actually was if the incoming organic matter (BOD) were to have been stabilized.

Analyses taken on November 1 and 2 indicated that suspended solids in the return sludge were 329 and 426 mg/l respectively. On these bases, the micro-organism populations are estimated to be 214 and 277 mg/l, or about 12 times lower than that normally found. Activated sludge should have a suspended solids concentration of between 2000 and 5000 mg/l; 65 percent of this would be volatile and representative of the micro-organism population.

The low micro-organism populations can be directly attributed to the inability of the final clarifiers to return the suspended material, which should be returned to and is required in the aeration section. The absence of a mechanical sludge collection system, e.g. scrapers, compounds the problem. Thus, the return sludge, with volatile suspended solids is in the undesirable range of 45 - 56% instead of in the desired range of 60 - 75%.

Consequently, it is concluded that significant improvements in the activated sludge process cannot be effected without major physical improvements to the final clarifiers.

3.4.3 Air Supply and Standby Power

Although the air compressor has remained operational since its installation in 1928, problems with leaky oil seals were evident.

Quantities of absorbant material are used to prevent the spread of machine oil in the control building.

In the event of power failure, standby power would not be available. The consequent loss of air supply to the aeration section would result in retardation of the biological processes. A prolonged power failure could result in an overall upset of the entire plant process, since treatment efficiency is largely based on a continuous air supply in the aeration section.

3.5 SECONDARY TREATMENT - FINAL CLARIFIERS

Final sedimentation is effected by two parallel settling tanks. Activated sludge is air lifted from each tank to a chamber immediately preceding the aeration section. Sludge is discharged, on an intermittent basis, to a municipally owned tank trailer.

Problem Areas

3.5.1 Size

Detention time, surface settling rate and weir overflow rate must fall within specific limits during the activated sludge processes to minimize problems with sludge loadings and settleability.

The following design parameters are normally used in activated sludge processes where the design flow is less than 1 mgd:

Type of Process	Detention Time (hrs)	Surface Settling Rate (gpd/sq.ft.)	Weir Overflow Rate (gpd/ft)
Conventional Activated Sludge (less than 1 mgd)	3	600*	10,000 (Max)

* Peak flow without a mechanical sludge collecting device.

The total surface area and volume of Palmerston's final clarifiers are 487 sq.ft. and 23,300 gallons respectively. Approximately 30 lineal feet of weir transmit supernatant from the clarifiers to the outfall structure.

The clarifiers handled an average daily flow of 304,000 gallons during the sampling program.

The surface settling and weir overflow rates calculated for flows on November 1 and 2, 1976, were respectively 633 gpd/sq.ft. and 10,133 gpd/lin.ft. of weir. Both rates are higher than the maxima suggested in the table above and greatly exceed the rates practical for day to day operation.

The clarifiers are much too small to handle the present wastewater flows and therefore are not successful when used as sedimentation basins. This results in heavy loss of solids over the weir. Therefore, it is impossible to maintain sufficient solids in the aeration tank at the desired concentration.

3.5.2 Design

The small surface area of both clarifiers results in short circuiting of the incoming mixed liquor suspended solids. In an attempt to improve the situation, makeshift baffles have been installed at the head of each tank. Their purpose was to create a quiescent zone in the tanks and thus promote better separation of the suspended solids. Only a minimal amount of separation, as indicated by the low concentration of suspended solids in the return sludge, occurs. Baffles were also installed at the rear of the clarifiers to reduce the amount of suspended solids being carried over the weir. However, analyses of final effluent samples indicate that, in the main, suspended solids concentrations are in excess of those normally desired.

The effectiveness of both sets of baffles is limited. No information is available on the situation prior to their installation. Records indicate that chemical polymer was, at one time, added to the final clarifiers to promote rapid settling. However, due to lack of adequate storage facilities, adverse operating conditions during winter months and poor access to the final clarifiers, the program was abandoned.

4.0 CONCLUSIONS

4.1 GENERAL CONCLUSIONS AND SUMMARY

4.1.1 The Palmerston Sewage Treatment Plant, in its present condition, cannot adequately treat municipal wastewater for the following reasons:

a) All treatment units are undersized.

b) Much equipment is outdated.

c) There are inherent design problems.

d) Certain necessary treatment and other units are absent.

4.1.2 Several other factors, which are beyond the direct scope of the study and this report may, either now or in the future, contribute to the plant's inability to treat incoming wastewater. They are:

a) Absence of a full time operator.

b) Lack of basic in-plant testing equipment.

c) The dilute nature of the incoming wastewater. The cause of the diluteness was not investigated. Roof leaders, basement sump pumps, faulty domestic connections to the main sewer, and the age of the main sewer itself may all contribute to this problem.

d) The location and size of the site.

e) The intermittent nature of the receiving stream.

4.2 DETAILED CONCLUSIONS ON PLANT DEFICIENCIES

The plant has so many deficiencies that the cost of the remedial measures necessary to ensure adequate sewage treatment would probably be prohibitive. However, if the plant is to continue in service, the following measures are required.

4.2.1 The effluent should be chlorinated before discharge to the Wallace drain. Proper chlorination equipment, a chemical storage facility and a chlorine contact chamber to ensure proper detention prior to discharge, should be provided.

4.2.2 The final clarifiers should be replaced with larger ones of improved design in order:

a) To permit satisfactory separation of the suspended solids from the mixed liquor to occur.

b) To ensure that a good quality activated sludge is available to the aeration section.

c) To eliminate excessive solids carry-over which interferes with proper chlorination of the final effluent.

4.2.3 The aeration section should be enlarged in order to provide a longer detention time. This would ensure that micro-organisms are in the proper growth phase when they are introduced into the final clarifiers. Good settling characteristics and a healthy activated sludge is the desired end result.

4.2.4 Standby power should be provided to ensure continuation of treatment during a power failure.

4.2.5 The control building should be enlarged to permit adequate housing and storage for chlorination equipment and materials.

4.2.6 An additional compressor should be installed in the building and operated on a full time basis. The original compressor could serve as a standby unit.

4.2.7 The gate valves located in the downstream end of the two grit chambers should be replaced with proportional weirs to permit a constant horizontal velocity through each channel to be maintained over a wide range of incoming flows.

4.2.8 The common wall separating the storm tank and influent channel should be repaired and modified to eliminate carry-over of raw sewage into the storm tank during periods when all three trunk sewers are discharging to the influent channel.

4.2.9 The storm tank should be taken out of service. More suitable bypass arrangements should be investigated.

4.2.10 The wet well pumping set-up should be modified. Large quantities of raw sewage discharged to the influent channel, via the forcemain, create surging problems within the plant. In addition, the influent channel should be enlarged so that overflow of raw sewage would be prevented.

4.2.11 The coarse bar screen in the inlet manhole should be maintained in a lowered position to ensure that debris does not reach the wet well and plug or damage the pump. The inlet manhole should be modified to permit easy removal of screenings from the coarse bar screen.

5.0 RECOMMENDATIONS

5.1 Based on the foregoing conclusions, it is recommended that, as a matter of urgency, either;

a) Extensive modifications to the existing sewage treatment plant should be undertaken, or,

b) A new sewage treatment facility should be constructed.

There is a strong possibility that modifications to the existing plant are not feasible.

5.2 It is also recommended that flows in the sewer system which are not sanitary in nature should be substantially eliminated.

APPENDIX I

DEFINITION OF TERMS

1. Activated Sludge - Sludge floc produced in raw or settled wastewater by the growth of bacteria and other organisms in the presence of dissolved oxygen and accumulated in sufficient concentration by returning floc previously formed.

2. Aeration - The bringing about of intimate contact between air and a liquid.

3. Aerobic - Requiring the presence of free elemental oxygen.

4. Anaerobic - Requiring the absence of free elemental oxygen.

5. Bacteria - Bacteria are microscopic one-celled plants. They are responsible for the purification of the organic pollution contained in waste and form the active part of floc. The bacterial species present are dependent on the nature of the organic matter to be decomposed.

6. Biochemical Oxygen Demand (BOD) - The biochemical oxygen demand of domestic wastewater is the amount of molecular oxygen required to stabilize the decomposable matter present in water by aerobic biochemical action. BOD_5 is the oxygen demand over a five day period.

7. Decomposition - Generally, this consists of aerobic processes that convert unstable materials into more stable forms by chemical or biological action. Waste

treatment encourages decay in a controlled situation so that material may be disposed of in a stable form. When organic material decays under anaerobic conditions, undesirable odours are produced. In aerobic processes, the odours are much less objectionable than those produced by anaerobic decomposition.

8. Effluent - Wastewater or other liquid, partially or completely treated or in its natural state, flowing out of a reservoir, basin, treatment plant or part thereof.

9. Influent - Water, wastewater, or other liquid flowing into a reservoir, basin, treatment plant or part thereof.

10. Inorganic - Chemical substances of mineral origin, or more correctly, not of basically carbon structure.

11. Mixed Liquor - A mixture of activated sludge and organic matter undergoing activated sludge treatment in the aeration tank.

12. Retention Time - The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by feed rate). Also called Detention Time or Period of Detention.

13. Stabilize - To convert to a form that resists change. Organic material is stabilized by bacteria which converts the material to gases and other relatively inert substances. Stabilized organic material generally will not give off obnoxious odours.

14. Suspended Solids - Solids that either float on the surface of, or are in suspension in water, wastewater, or other liquids and which are largely removable by laboratory filtering.

15. Volatile Solids - The quantity of solids in water, wastewater, or other liquids, lost on ignition of the dry solids at 550°C.

16. Wastewater - The spent water of a community. It may be a combination of liquid and water-carried solid wastes from residences, commercial buildings, industrial plants and institutions, together with any groundwater, surface water and stormwater that may have entered the community's sanitary sewer system.

APPENDIX II

DATES OF PREVIOUS REPORTS
AND STATUS OF RECOMMENDATIONS

1. DECEMBER 1961 REPORT

Recommendations

1. That the activated sludge process be re-established.
2. Regular sampling program for raw sewage/ final effluent.
3. Purchase of lab equipment to run tests for purpose of process control.

Status of Recommendations

NONE IMPLEMENTED.

2. APRIL 5, 1962 REPORT

Recommendations

1. A suitable metering device be provided at plant.
2. Regular monthly composite samples of raw sewage/final effluent be submitted to OWRC Lab in Toronto.

Status of Recommendations

NONE IMPLEMENTED.

3. JUNE 12, 1963 REPORT

Recommendations

1. The activated sludge process should be reestablished.
2. A flow measuring device and totalizer should be installed.
3. Composite sampling program should be initiated.
4. Improve plant efficiency by upgrading plant or by providing a polishing pond for effluent.
5. Purchase of Lab equipment to assist in regulating plant process.

Status of Recommendations:

NONE IMPLEMENTED.

4. JANUARY 11, 1964 REPORT

Recommendations

1. Lab equipment should be purchased.
2. Air flow meter should be repaired.
3. Composite sampling program should be implemented.

Status of Recommendations

NONE IMPLEMENTED.

5. SEPTEMBER 5, 1964 REPORT

Recommendations

1. Qualified plant operator and part-time assistant should be retained by Palmerston.
2. Chief Operator - full-time basis.
3. Metering and testing equipment should be purchased.
4. Plant should be cleaned up and survey of necessary repairs should be detailed by plant operator.
5. Regular sampling program should be established by operator.
6. Record keeping program should be initiated by operator.
7. Consulting engineer should be retained by Town to assess adequacy of plant and make recommendations on necessary improvements or alternate methods of treatment.

Status of Recommendations

NONE IMPLEMENTED.

APPENDIX III

Information relative to the assumption of the responsibility by the Ministry of the Environment's Utility Operations Branch for Plant Operations

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CONTENTS

1. Ministry Internal memorandum from D.A. McTavish to E. F. Heath. December 28, 1971.

2. Letter from D.A. McTavish, Director, Division of Plant Operations to R. J. Saunders, Clerk Treasurer to the Town of Palmerston, dated December 23, 1971.

3. Copy of Temporary Operating Terms.
Draft agreement between the Ontario Water Resources Commission and the Town of Palmerston.

December 28, 1971

E. F. Heath,
Director of Finance.

D. A. McTavish,
Director of Plant Operations.

TOWN OF PALMERSTON OPERATIONAL WATER POLLUTION CONTROL PLANT

Attached you will find the copy of a letter to Mr. F. J. Saunders, Clerk-Treasurer, Town of Palmerston outlining interim terms for the operation of the Palmerston WPCP. The terms will be only in effect until either acceptance or rejection of the formal operating agreement is received from the O.M.B.

There have been several council meetings attended by our Mr. Hansler and Mr. K. Brown from Project Development which have led up to the development of these interim terms of operation.

You will note that Project Development has chosen the provincial project number; however, in fact, the municipality will be billed directly on a quarterly basis while the interim agreement is in effect. In addition any under or over expenditure of the annual operating budget will be treated in the usual municipal-financed project manner.

If the Town of Palmerston accept this proposal, then an operating budget prepared in our usual format will be presented to your attention. We will advise you of the date to commence billing.

D. A. McTavish,
Director.

BWH:fl
Encl.

cc: K. Brown, Proj. Dev.

E. McMurray, San. Eng.

1651

December 23, 1971

Mr. R. J. Saunders,
Clerk-Treasurer,
Town of Palmerston,
P. O. Box 88,
Palmerston, Ontario.

Dear Sir,

RE: TOWN OF PALMERSTON 1-0126-69
WATER POLLUTION CONTROL PLANT
OPERATING AGREEMENT

At the council meeting of December 16, 1971 an agreement by-law and an agreement document to operate the Palmerston Water Pollution Control Plant (WPCP) were left with council for its consideration. If council is in agreement to the estimated renovation cost of $3,650.00 and to the estimated operating budget of $8,100.00, the agreement by-law can be passed which will start the formal procedure to enter into an operating agreement with the OWRC. However the length of time to complete the operating agreement is unknown and may require several months. It was therefore suggested that a letter outlining interim terms of WPCP operation be submitted to council. Receipt of council's approval of the terms will allow the OWRC's Division of Plant Operations to commence with the renovation and operation of the WPCP immediately.

The interim terms for the operation of the Palmerston WPCP by the OWRC's Division of Plant Operations are enclosed.

The renovation estimate of $3,650.00 will be included in the estimated operating budget for quarterly billing purposes. Therefore the municipality will be billed quarterly for the first annual sum of $11,750.00. For subsequent years of operation it is normal practice to meet with council each year and present the annual operating budget.

We are looking forward to receiving your acceptance of these interim terms of operation and the executed agreement by-law so that work to renovate your WPCP may start as soon as possible.

Yours very truly,

D. A. McTavish, P. Eng.,
Director,
Division of Plant Operations.

BCH:fl
Encl.

cc: K. Brown
E. Heath
R. McMurray

PALMERSTON WPCP

(TEMPORARY OPERATING TERMS)

1. The Commission will operate, supervise, control, maintain, repair, administer and insure the said as more particularly described in Schedule "A" hereto.

2. The Municipality hereby releases and discharges, and covenants and agrees at all times to indemnify and save harmless, the Commission from and against all claims, including :

   (i) all claims for injuries, including injuries resulting in death, to any person or persons, whether such injuries be caused or contributed to by the negligence of the Commission, its officers, agents, servants or employees, or otherwise; and

   (ii) all claims, actions and awards under the Workmen's Compensation Act or similar Acts; and

all demands, liability, loss, costs, damages, expense, compensation, awards, or payments of every kind or nature whatsoever, and all actions, suits or proceedings, of every kind or nature whatsoever, by whomsoever incurred, sustained, suffered, made, paid, brought or taken and in any manner connected with, caused by or attributable to the entering into of this Agreement or the performance of or the failure to perform the terms and conditions thereof.

3. The Commission may shut off or reduce the volume of sewage received or accepted from the Municipality in cases of emergency or break-down or when it may otherwise be necessary in the performance of this Agreement, but the Commission shall, when practicable, endeavour to give to the Municipality reasonable notice of intention to shut off or reduce the volume of sewage.

4. The Municipality to the extent of its power and authority shall not permit any waste which, in the opinion of the Commission, may damage or interfere with the operation of the said sewage works to be deposited or discharged into any sewer connected directly or indirectly to the said sewage works.

5. The Municipality agrees to pay to the Commission, in each calendar year during the term of this Agreement, commencing with the calendar year in which the Commission commences the operation of the said sewage works the following sums :

(a) The total cost to the Commission, in each such year, of the operation, supervision, maintenance, repair, administration and insurance of the said sewage works ; and

6. (a) The Municipality shall pay the Commission quarterly and not later than the 15th days of March, June, September and December of each year the sums due hereunder by the Municipality to the Commission in accordance with the precept of the Commission directed to the Municipality for each such year.

(b) The mailing by the Commission of a precept by registered mail in an envelope addressed to the clerk of the Municipality shall constitute delivery of the precept to the clerk of the Municipality.

(c) In each calendar year the Commission shall deliver to the Municipality a statement showing how the charges hereinbefore referred to are made up.

7. The Commission shall not extend or enlarge the said sewage works without the written consent of the Municipality.

8. No municipality other than the Municipality party to this agreement, shall be connected to the said sewage works without the written consent of the parties hereto.

9. This agreement shall be and remain in force until superseded by the formal operating agreement.

Not withstanding the above the Commission may terminate this agreement by giving notice in writing, by registered mail, addressed to the clerk of the Municipality, designating a date, which thereafter be called the "date of termination". On the date of termination of this

Agreement the Commission will transfer to the Municipality at the expense of the Municipality, the management, control and operation of the said sewage works.

10. Notwithstanding the termination of this Agreement by the expiration of the term hereof, or termination of this Agreement by the Commission, as hereinbefore set out, and the subsequent transfer and delivery of possession of the said sewage works to the Municipality by the Commission, within 60 days of the expiration or termination of this Agreement, the Municipality will pay to the Commission, forthwith upon receipt of the precept of the Commission, any sum or sums in relation to the operation, supervision, control, maintenance, repair, administration and insurance of the said sewage works, ascertained by the Commission on a final adjustment, to be owing to the Commission, upon receipt of payment of which, all obligations of the Municipality to the Commission will have been discharged by the Municipality to the Commission.

TOWN OF PALMERSTON

SCHEDULE A

The sewage works consists of an activated sludge sewage treatment plant basically built in the early 1950's with the following treatment units :

1. 2 concrete grit channels each 16.0' x 2.0' x 4.1'
2. 4 concrete aeration tanks each 28.0 x 7.6' x 8.3'
3. 2 concrete final clarifiers each 15.6' x 15.6'
4. 1 brick control building (approximately 18' x 18') which contains one sludge loading pump and one 340 CFM blower and 25 HP electric driving motor.
5. 1 submersible raw sewage pump.
6. Chlorination facilities ?
7. Associated piping and appurtenances.
8. Return sludge facilities are air lift design.

APPENDIX IV

DETERMINATION OF HYDRAULIC RATING

In this appendix, on Pages AIV-2 to 7, the characteristics of the different types of activated sludge plant are discussed and the possibilities that the Palmerston Sewage Treatment Plant might be rated at either 500,000 GPD, 400,000 GPD, 300,000 GPD, 200,000 GPD or 150,000 are assessed.

It is concluded that the most appropriate rating is 150,000 GPD, but that for this and the other flows examined, the plant's treatment capability is very limited.

1. CHARACTERISTICS OF DIFFERENT TYPES OF ACTIVATED SLUDGE SEWAGE TREATMENT PLANTS

	AERATION SECTION			FINAL CLARIFIERS		
Type of Treatment Process	BOD Loading		Aeration Period (hours)	Retention Time (hours)	Surface Settling gpd/sq.ft.	BOD Removal %
	lbs BOD 1000 cu.ft.	lbs BOD lbs VSS				
Conventional	30 - 40	0.2 -0.5	6 - 7.5	3	600	95
High Rate	100 plus	0.5 -1.0	2.5 - 3.5	2.5	700	85 - 90
Step Aeration	30 - 50	0.2 -0.5	5.0 - 7.0	2	800	90 - 95
Contact Stabilization	30 - 50	0.2 -0.5	6.0 - 9.0	3.6	500	85 - 90
Extended Aeration	10 - 30	0.05-0.2	20 - 30	4	300	85 - 90

NOTES

a) The Palmerston sewage treatment plant was apparently designed on the assumption that the average daily wastewater flow would be 500,000 gallons. Sanitary sewage generated by the Town is basically domestic in nature. The BOD_5 of raw domestic sewage ranges from 80 mg/l to 220 mg/l. Brief descriptions of the various types of activated sludge processes are given below.

b) Description of Various Activated Sludge Systems

i) Conventional Activated Sludge

This design employs primary clarifiers ahead of the aeration section to remove easily settled solids. These solids are removed and provided further treatment in a digestor (usually anaerobic). Following the aeration section, a secondary clarifier settles the activated sludge and returns it proportionately to the aeration section and primary clarifier.

ii) High Rate

This process is usually used where fractional treatment is required. With or without a primary clarifier, a completely mixed aeration tank is used followed by final clarifiers and sludge return. Waste sludge can be directed to a holding tank or aerobic digester.

iii) Step Aeration

This is a modification of the conventional system. Effluent from the primary clarifiers is fed in steps along the aeration tank and is thereby distributed more uniformly to the activated sludge mass. An anaerobic digester is usually employed to stabilize waste sludge.

iv) Contact Stabilization

No primary clarification is employed with this process. Wastewater is mixed in a contact aeration tank with stabilized activated sludge before being directed to clarifiers. Settled sludge is pumped from the clarifier and passed through a reaeration tank for further treatment before being returned to the contact aeration section. Excess activated sludge is usually stabilized in an aerobic digester.

v) Extended Aeration

This process involves longer periods of aeration detention. Usually no primary clarification is employed. Wastewater flows directly to the aeration tank and then to a final clarifier. Waste activated sludge is directed to either a holding tank or an aerobic digestor.

2.0 LOADING AND OPERATIONAL PARAMETERS FOR VARIOUS FLOWS FROM 500,000 GPD TO 150,000 GPD AT THE PALMERSTON SEWAGE TREATMENT PLANT

In this paragraph design flows of 500,000 GPD, 400,000 GPD, 300,000 GPD, 200,000 GPD and 150,000 GPD are used to synthesize data to test the plant's hydraulic capacity.

2.1 500,000 GPD FLOW - VARIOUS ORGANIC STRENGTHS

If a design flow of 500,000 gpd is used and BOD concentrations of 80 mg/l, 150 mg/l and 200 mg/l are assumed, the following loading and operational parameters can be calculated.

	AERATION SECTION		FINAL CLARIFIERS	
BOD	lbs BOD per 1000 cu.ft.	Aeration Period (hours)	Detention Time (hours)	Surface Settling Rate (gpd/sq.ft.)
80 mg/l	56.7	2.1	1.3	1027
150 mg/l	106.2	2.1	1.3	1027
200 mg/l	141.5	2.1	1.3	1027

NOTES

Comparing these results with the criteria in Paragraph 1, the following observations are made:

a) A loading of 80 mg/l on the aeration section does not conform with any standard process. In addition, both the aeration section and final clarifiers are too small to handle the flow.

b) With incoming BOD strengths of 150 mg/l and 200 mg/l, the loading on the aeration section suggests that the High Rate Activated Sludge process is employed. However, this is ruled out for the following reasons:

   i) There are no primary settling tanks.

   ii) The aeration period is insufficient for the high rate process.

   iii) The detention time is insufficient for proper settling of MLSS in the final clarifiers.

   iv) The surface settling rate is well above that recommended for high rate activated sludge plants.

c) Consequently, even if the strength of the incoming sewage is ignored, the plant does not have the hydraulic capacity for 500,000 gallon average daily sewage flows.

2.2 400,000 GPD FLOW AND 80 mg/l BOD

	AERATION SECTION	FINAL CLARIFIERS	
lbs BOD per 1000 cu.ft.	Aeration Period (hrs)	Detention Time (hours)	Surface Settling Rate (gpd/sq.ft.)
45.3	2.65	1.68	821

At this flow, the loading on the aeration section suggests that the process might be either step aeration or contact stabilization. However, the operational and loading parameters for both of these processes differ greatly from those available. A rating of 400,000 gpd is, therefore, too great for the Palmerston Plant.

2.3 300,000 GPD FLOW AND 80 mg/l BOD

	AERATION SECTION	FINAL CLARIFIERS	
lbs BOD per 1000 cu.ft.	Aeration Period (hrs)	Detention Time (hours)	Surface Settling Rate (gpd/sq.ft.)
34	3.53	2.24	616

At this flow, the loading on the aeration section suggests that the process might be classified as either conventional, contact stabilization or step aeration. However, the layout requirement for these processes eliminates the possibility of employing them. The inadequate aeration period and detention time in the final clarifiers prevents the process from being classified as a conventional activated sludge process.

2.4 200,000 GPD FLOW AND 80 mg/l BOD

	AERATION SECTION	FINAL CLARIFIERS	
lbs BOD per 1000 cu.ft.	Aeration Period(hrs)	Detention Time (hours)	Surface Settling Rate (gpd/sq.ft.)
22.6	5.3	3.36	411

At this flow, the loading on the aeration section suggests that the process might be extended aeration. However, the aeration period is one-quarter to one-fifth of that required. Further, the final clarifiers are unsuitable and inadequately sized and could not satisfactorily separate suspended solids from the mixed liquor.

Consequently, it is concluded that, regardless of the applied average daily flow, the plant is not designed to treat raw sewage having a BOD_5 concentration of 80 mg/l.

2.5 150,000 GPD FLOW AND 150 mg/l BOD

	AERATION SECTION	FINAL CLARIFIERS	
lbs BOD per 1000 cu.ft.	Aeration Period (hrs)	Detention Time (hours)	Surface Settling Rate (gpd/sq.ft.)
31.8	7.1	4.5	308

The operations could, loosely, be classified as a conventional activated sludge process with a 150,000 gpd hydraulic capacity. The BOD_5 concentration should be in the range of 140 mg/l to 185 mg/l.

APPENDIX V

RECORDED FLOWS AT PLANT
MAY 11 - JUNE 3, 1976 INCLUSIVE

Date	Plant Effluent (MIGD) 90 V-Notch Weir	Sewage Bypass (MIGD) 2.5 Rectangular Weir
May 11	.338	Recorder not installed
May 12	.338	Recorder not installed
May 13	.338	Recorder not installed
May 14	.345	Recorder not installed
May 16	.345	Recorder not installed
May 17	.348	Recorder not installed
May 18	.346	Recorder not installed
May 19	.310	Recorder not installed
May 20	.317	Recorder not installed
May 21	.296	Recorder not installed
May 22	.273	.043
May 23	.268	.027
May 24	.269	.035
May 25	.262	.033
May 26	.286	.025
May 27	.281	.028
May 28	.273	.032
May 29	.270	.021
May 30	.259	.018
May 31	.332	.045
June 1	.338	.007
June 2	.315	.010
June 3	.330	.004
Average	.304	

APPENDIX VI

ANALYSIS RESULTS OF RAW AND TREATED SEWAGE

N.B. - Results, obtained outside study period during normal plant operations, are based on grab samples. Composite sampling results, given in later tables are expected to be more accurate.

DATE	BOD_5 (mg/l)		SUSPENDED SOLIDS (mg/l)	
	Raw	Final	Raw	Final
Jan 30/73	22	8	30	20
Apr 3/73	6.5	6.5	210	30
May 1/73	8	10	15	20
Sep 11/73	60	17	40	30
Oct 9/73	75	42	30	10
Nov 28/73	160	9.5	400	50
Average	55.3	15.5	120.8	26.7
Per Cent Removal	72%		78%	
Jan 14/74	170	19	140	20
Feb 12/74	95	15	110	12
Feb 28/74	70	12	75	25
Mar 14/74	32	7	45	15
Mar 28/74	130	12	20	15
Apr 9/74	19	4	15	15
Jun 12/74	11	18	15	20
Jun 26/74	12	8	35	15
Jul 23/74	12	18	20	30
Sep 3/74	30	7	60	50
Oct 13/74	130	20	100	20
Average	59.9	12.5	57.9	20.6
Per Cent Removal	79.2%		64.4%	
Aug 20/75	36	20	40	35
Nov 11/75	6	17	50	15
Dec 3/75	54	30	85	75
Dec 12/75	16	18	55	35
Average	25.3	21.7	63.3	41.7
Per Cent Removal	14.2%		44.1%	

DATE	BOD_5 (mg/l)		SUSPENDED SOLIDS (mg/l)	
	Raw	Final	Raw	Final
Jan 20/76	100	20	150	45
Feb 26/76	70	60	130	20
Apr 6/76	22	8	124	14
Aug 24/76	100	75	65	5
Sep 28/76	55	32	68	59
Oct 19/76	14	22	51	31
*Nov 16/76	780	36	6914	80
Average	60	36.2	98	29
Per Cent Removal	39.6%		70.4%	

*Analyses results of November 16, 1976 were not used in the computation of average and % removal because of apparent anomolous character.

NOTE: The following results are based on 24 hour composite samples obtained by the Ministry of the Environment over a 37 day period.

These results represent an accurate assessment of the relative strengths of various constituents contained in the raw sewage and final effluent.

DATE	BOD$_5$ (mg/l)		SUSPENDED SOLIDS (mg/l)	
	Raw	Final	Raw	Final
April 29	14	11.5	87	38.5
April 30	11	9.5	22.5	15.5
May 1	12	6.5	26	14.5
May 2	16	10.5	27.5	19.5
May 3	126	14.5	76.5	27
May 4	20.5	10.5	27	19.5
May 5	23	8.5	32.5	23.5
May 6	14	6.5	35.5	39
May 7	17	7	22.5	19
May 8	7.5	8	13.5	16
May 9	13.5	9.5	26.5	20
May 10	24	14.5	38.5	20.5
May 11	7.5	7.5	21.5	20.5
May 12	9	6	32	15.5
May 13	16	6.5	53	36
May 14	24	9	42	20.5
May 15	22.5	9.5	44	25.5
May 16	18.5	6	39.5	19
May 17	40	23.5	60	47
May 18	34	13	113.5	52.5
May 19	27	16	35	34.5
May 20	34	11.5	46.5	20
May 21	37.5	6	49.5	17.5
May 22	28	8	42.5	17
May 23	24.5	5	42	17.5
May 24	41	10.5	81.5	25.5

DATE	BOD$_5$ (mg/l)		SUSPENDED SOLIDS (mg/l)	
	Raw	Final	Raw	Final
May 25	82.5	12.5	64.5	29.5
May 26	41.5	17.5	65	34
May 27	53.5	20.5	73	33.5
May 28	37	23.5	68	21
May 29	70	16	66	42.5
May 30	67.5	13	59	16
May 31	67	29	123	45
June 1	79.5	23	91	45
June 2	135	16.5	109	32.5
June 3	65	23	87	44
Average	37.8	12.5	54.0	27.0
Per Cent Removal	66.9%		49.6%	

NOTE: The following results are based on eight 6-hour effluent composite samples obtained over a 48 hour period and four influent grab samples obtained during the same period.

* Grab Samples

DATE	PERIOD (Hours)	BOD_5 (mg/l)		SUSPENDED SOLIDS (mg/l)	
		Raw	Final	Raw	Final
Nov 1	12 noon - 6pm	42	41	99	492
	6 pm - midnight		42		101
	midnight - 6am		42		570
	6 am - 12 noon	—	42	—	494
	Average	42	42	99	414
	Per Cent Removal	0%		0%	
Nov 2	12 noon - 6 pm	42	42	102	461
	6 pm - midnight		42		61
	midnight - 6 am		38		45
	6 am - 12 noon	—	34	—	35
	Average	42	39	102	150
	Per Cent Removal	7%		0%	

TABLE I

ANALYSIS RESULTS

(April 29 - June 3 Incl)

DATE	TIME	RAW SEWAGE		FINAL EFFLUENT	
		BOD (mg/l)	SUSP. SOLIDS (mg/l)	BOD (mg/l)	SUSP. SOLIDS (mg/l)
April 29	7 am-5 pm	20	133	11	47
April 29-30	5 pm-7 am	8	42	12	30
April 30	7 am-5 pm	15	22	9	14
April 30-May 1	5 pm-7 am	7	23	10	17
May 1	7 am-5 pm	16	33	9	18
May 1-2	5 pm-7 am	8	19	4	11
May 2	7 am-5 pm	18	31	12	17
May 2-3	5 pm-7 am	14	24	9	22
May 3	7 am-5 pm	220	101	14	29
May 3-4	5 pm-7 am	32	52	15	25
May 4	7 am-5 pm	28	32	13	27
May 4-5	5 pm-7 am	13	22	8	12
May 5	7 am-5 pm	28	32	8	25
May 5-6	5 pm-7 am	18	33	9	22
May 6	7 am-5 pm	16	29	8	34
May 6-7	5 pm-7 am	12	42	5	44
May 7	7 am-5 pm	26	24	8	21
May 7-8	5 pm-7 am	8	21	6	17
May 8	7 am-5 pm	8	15	9	19
May 8-9	5 pm-7 am	7	12	7	12
May 9	7 am-5 pm	15	30	12	28
May 9-10	5 pm-7 am	12	23	7	12
May 10	7 am-5 pm	28	43	15	25
May 10-11	5 pm-7 am	20	34	14	16
May 11	7 am-5 pm	11	27	6	23
May 11-12	5 pm-7 am	4	16	9	18
May 12	7 am-5 pm	10	24	6	26
May 12-13	5 pm-7 am	8	40	6	5
May 13	7 am-5 pm	16	71	6	53
May 13-14	5 pm-7 am	16	35	7	19
May 14	7 am-5 pm	40	65	12	18
May 14-15	5 pm-7 am	8	19	6	23
May 15	7 am-5 pm	28	45	8	29
May 15-16	5 pm-7 am	17	43	11	22
May 16	7 am-5 pm	20	42	5	18
May 16-17	5 pm-7 am	17	37	8	20
May 17	7 am-5 pm	50	68	30	60
May 17-18	5 pm-7 am	30	52	17	34
May 18	7 am-5 pm	28	144	11	83
May 18-19	5 pm-7 am	40	83	15	22
May 19	7 am-5 pm	40	48	24	62
May 19-20	5 pm-7 am	14	22	8	7

DATE	TIME	RAW SEWAGE		FINAL EFFLUENT	
		BOD (mg/l)	SUSP. SOLIDS (mg/l)	BOD (mg/l)	SUSP. SOLIDS (mg/l)
May 20	7 am-5 pm	48	66	9	13
May 20-21	5 pm-7 am	20	27	14	21
May 21	7 am-5 pm	40	54	6	19
May 21-22	5 pm-7 am	9	30	3	16
May 22	7 am-5 pm	60	73	5	15
May 22-23	5 pm-7 am	15	26	7	20
May 23	7 am-5 pm	60	97	11	27
May 23-24	5 pm-7 am	22	66	10	24
May 24	7 am-5 pm	45	58	8	19
May 24-25	5 pm-7 am	11	27	8	15
May 25	7 am-5 pm	120	74	8	23
May 25-26	5 pm-7 am	45	55	18	36
May 26	7 am-5 pm	55	81	16	36
May 26-27	5 pm-7 am	28	49	19	32
May 27	7 am-5 pm	65	92	17	29
May 27-28	5 pm-7 am	42	54	24	38
May 28	7 am-5 pm	34	109	21	22
May 28-29	5 pm-7 am	40	27	26	20
May 29	7 am-5 pm	55	45	13	70
May 29-30	5 pm-7 am	85	87	18	15
May 30	7 am-5 pm	85	76	12	18
May 30-31	5 pm-7 am	50	42	14	14
May 31	7 am-5 pm	100	155	28	49
May 31 - June 1	5 pm-7 am	34	92	30	41
June 1	7 am-5 pm	74	65	22	43
June 1-2	5 pm-7 am	85	117	24	47
June 2	7 am-5 pm	160	119	18	29
June 2-3	5 pm-7 am	110	100	15	36
June 3	7 am-5 pm	80	93	23	42
June 3-4	5 pm-7 am	50	81	24	46

TABLE 2

SAMPLING PROGRAM

(November 1,2 and 3)

DATE 1976	SAMPLE PERIOD	RAW SEWAGE		FINAL EFFLUENT	
		BOD (mg/l)	SUSP. SOLIDS (mg/l)	BOD (mg/l)	SUSP. SOLIDS (mg/l)
Nov 1	12 noon - 6 pm	-	-	41	492
Nov 1	6 pm-12 midnight	-	-	42	101
Nov 2	12 midnight-6am	-	-	42	570
Nov 2	6 am - 12 noon	-	-	42	494
Nov 2	grab sample(1 pm)	42	99	22	72
Nov 2	12 noon - 6 pm	-	-	42	461
Nov 2	6 pm-12 midnight	-	-	42	61
Nov 3	12 midnight-6 am	-	-	38	45
Nov 3	6 am - 12 noon	-	-	34	35
Nov 3	grab sample(1 pm)	42	102	34	108

DATE 1976	SAMPLE PERIOD	AERATION TANK		RETURN SLUDGE
		Susp. Solids (mg/l)	Volatile Susp. Solids (mg/l)	Susp. Solids (mg/l)
Nov 2	Grab	225	126	329
Nov 3	Grab	336	151	426

APPENDIX VII

TOWN OF PALMERSTON
SEWAGE WORKS SYSTEM DETAILS

Project No.	- 1-0216-69
Treatment	- Activated Sludge
Design Flow	- 150,000 Imp. gal/day (based on a surface settling rate of 300 Imp. gal/sq.ft. of final clarifier/day)
Design BOD	- 140-185 mg/l (medium strength domestic wastewater)
Design Suspended Solids	- 160 mg/l

Influent Works

Three sewers discharge to the plant, two by gravity and one via a forcemain.

a) 20 inch diameter (gravity)

b) 18 inch diameter (gravity)

c) 18 inch diameter gravity sewer discharges to an inlet manhole from the Prospect Street sewage lift station serving the south-eastern section of Palmerston. The pumping station is a 100 USgpm Smith and Loveless factory built Monoject unit. Sanitary sewage is lifted into the gravity system and discharged to an inlet manhole located at the plant. From here, the sewage passes through a coarse bar screen and is transported by a 24 inch diameter discharge pipe to a wet well. A float controlled 400 Imp. gal/min. Flygt pump lifts the sewage through a 6 inch diameter forcemain which discharges to the influent channel near the two gravity lines.

Screening

A coarse manually cleaned bar screen is located in the influent channel downstream of the two gravity sewers and forcemain.

Grit Removal

Grit removal is effected by two (2ft. x 16ft. x 4ft. deep) manually cleaned channels.

Aeration Tanks

The flow is directed to two, two-pass diffused air aeration tanks.

Unit Dimensions	- 4 @ 28 ft. x 7.6 ft. x 8.3 ft.
Total Volume	- 44,200 Imp. gallons
Detention at Design Flow	- 4.4 hours

Air Supply

Bellis and Norcom Ltd., 340 cfm compressor @ 8 psi

Final Settling Tanks

Two parallel cone shaped tanks

Unit Dimensions	- 2 @ 15.6 ft. x 15.6 ft. Hopper Bottom
Total Volume	- 23,300 Imp. gallons
Detention at Design Flow	- 2.8 hours
Overflow Rate	- 600 gal/ft 2/day (maximum)

Sludge is air lifted to the mixing chamber immediately preceding the aeration section

Storm Flow Tank

Storm flows are retained in an 8 ft. x 27 ft. x 3 ft.

Outfall

The plant effluent is discharged to the Wallace Drain, which empties into the little Maitland River.

Sludge Disposal

Sludge is wasted to a municipal tanker and disposed of on agricultural lands.